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U.S. Department
of Transportation

East Building, PHH-30
1200 New Jersey Avenue S.E.
Washington, D.C. 20590

**Pipeline and Hazardous
Materials Safety Administration**

DOT-SP 14232
(SIXTH REVISION)

EXPIRATION DATE: 2020-02-29

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: Luxfer Inc.
dba Luxfer Gas Cylinders
Riverside, CA
2. PURPOSE AND LIMITATION:
 - a. This special permit authorizes the manufacture, mark, sale and use of a non-DOT specification cylinder conforming with ISO Standard 11119-2, except as specified herein, for the transportation in commerce of the materials authorized by this special permit. This special permit provides no relief from the Hazardous Materials Regulations (HMR) other than as specifically stated herein. The most recent revision supersedes all previous revisions.
 - b. The safety analyses performed in development of this special permit only considered the hazards and risks associated with transportation in commerce.
3. REGULATORY SYSTEM AFFECTED: 49 CFR Parts 106, 107 and 171-180.
4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR §§ 173.302(a), 173.304(a) and § 180.205 in that a non-DOT specification cylinder is not authorized, except as specified herein.
5. BASIS: This special permit is based on the application of Luxfer Inc. dba Luxfer Gas Cylinders dated February 23, 2016, submitted in accordance with 49 CFR § 107.109.

6. HAZARDOUS MATERIALS (49 CFR § 172.101):

Hazardous Materials Description			
Proper Shipping Name	Hazard Class/ Division	Identification Number	Packing Group
Air compressed (containing up to 39% by volume oxygen)	2.2	UN1002	N/A

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Packaging prescribed is a non-DOT specification composite cylinder as described in Luxfer Inc.'s application on file with the Office of Hazardous Materials Safety Approvals and Permits Division. The cylinder must meet all the requirements of the ISO Standard 11119-2: 2002 (Gas Cylinders of Composite Construction-Specification and Test Methods - Part 2). Additionally, the cylinder must meet the following:

(1) The ratio of burst pressure (P_b) over service pressure (P_s) must be greater than or equal to 3.4 ($P_b/P_s = 3.4$).

(2) All batch cycling performance testing must meet the requirement of ISO 11119-2 for 30 year service life. The minimum number of cycling performance testing must meet one of the following:

(i) 15,000 cycles with the value of the upper hydraulic cyclic pressure ≥ 1.25 times the service pressure; or

(ii) 7,500 cycles with the value of the upper cyclic pressure = hydraulic test pressure (p_h).

(3) Authorized Liner Materials: The liner must be a seamless cylinder made of one of the following aluminum alloys: 6061-T6, 7032-T6 or 7060-T6.

(i) The liner may be produced by cold or hot backward extrusion; cold drawing; or from an extruded tube with swaged or spun ends.

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(ii) The material composition of the alloy used must be within the limits prescribed herein:

ELEMENT	ALLOY 6061		ALLOY 7032		ALLOY 7060	
	MIN %	MAX %	MIN %	MAX %	MIN %	MAX %
Silicon	0.40	0.80		0.07		0.15
Iron		0.70		0.1		0.2
Copper	0.15	0.40	1.7	2.3	1.8	2.6
Manganese		0.15		0.05		0.20
Magnesium	0.80	1.20	1.5	2.2	1.3	2.1
Chromium	0.04	0.35	0.16	0.22	0.15	0.25
Zinc		0.25	5.7	6.5	6.1	7.5
Titanium		0.15		0.1		0.05
Lead		0.005		0.005		0.005
Bismuth		0.005		0.005		0.005
Others Each		0.05		0.05		0.05
Others Total		0.15		0.15		0.15
Aluminum	Remainder		Remainder		Remainder	

(iii) The liner interior surface shall be smooth. Any fold in the neck region due to the forming or spinning process must not be sharp or deep or detrimental to the integrity of the cylinder. Inner surface defects may be removed by machining or other method, provided the metal loss is minimal and the minimum required wall thickness is maintained.

(iv) Liner ends must be concave to pressure.

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(v) Prior to any test, all liners must be subjected to a solution heat treatment and aging heat treatment appropriate for the aluminum alloy used. The process must produce liners of uniform temper and properties.

(vi) The limits for the mechanical properties of the alloy used for the liner prior to filament winding shall be as follows:

	ALLOY 6061		ALLOY 7032		ALLOY 7060	
	MIN	MAX	MIN	MAX	MIN	MAX
Yield Strength	241.3 MPa (35,000 psi)			470.0 MPa (68,200 psi)		470.0 MPa (68,200 psi)
Ultimate Strength	262.0 MPa (38,000 psi)			525.0 MPa (76,200 psi)		525.0 MPa (76,200 psi)
Elongation	12%		12%		12%	

(vii) The outer surface of each liner must be protected from any galvanic corrosion that may occur due to dissimilar materials (aluminum and carbon fibers) in contact. A suitable polymer coating or glass-fiber/epoxy composite layer may be used for this purpose.

(4) Physical tests to determine yield strength, tensile strength and elongation of the aluminum liner material must be conducted in accordance with ISO 7866:1999 Sections 10.1.2 (a) (1) and (2).

(5) Service pressure may not exceed 345 bar (5,000 psi).

(6) Water volume may not exceed 91 liters (200 lb).

(7) Each cylinder must be fitted with a pressure relief device in accordance with § 173.301(f).

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(8) Cylinder valve protection must be in accordance with § 173.301(g).

(9) Cylinder test pressure is 3/2 of the marked service pressure.

b. MARKING:

(1) Each cylinder must be permanently marked (other than by stamping) in the composite on the sidewall. The marking must be easily visible and must be protected from external damage due to the environment and handling.

(2) The marking must contain the following:

(i) DOT special permit number (DOT-SP 14232) followed by service pressure expressed in bar (psi).

(ii) A serial number and the manufacturer's identification number or a symbol as obtained from the Associate Administrator for Hazardous Materials Safety, located just below or immediately following the DOT marking above.

(iii) The DOT inspector's official mark must be placed near the serial number. The marking must contain date the (month and year) of the initial hydraulic proof pressure test for that cylinder.

(iv) The size of the letters and numbers used must be at least 0.64 cm (1/4 inch) high if space permits.

(v) The following are examples of an authorized format for marking:

DOT-SP 14232-300 bar (4,350 psi)
1234-MMI (or symbol)
II-MM/YY

(vi) Additional markings are permitted in the composite, provided the additional markings do not obscure the required marking and are not detrimental to the integrity of the cylinder.

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(vii) Provisions for marking of the required requalification dates and RIN information must be made near the cylinder markings.

c. REQUALIFICATION: -

(1) Each cylinder must be requalified once every 5 years by a qualified person holding a valid DOT RIN using a hydraulic proof pressure test equal to 1.5 times the marked service pressure and hold the pressure for a minimum of 3 minutes without a loss of pressure. Alternatively, cylinders may be volumetrically tested by the water jacket method suitable for the determination of settled test pressure for one minute. For a volumetric test method, cylinders exhibiting a ratio of permanent to total expansion exceeding 5% must be condemned in accordance with § 180.205. Each cylinder must visually be inspected in accordance with CGA Pamphlet C-6.2 Guidelines for Visual Inspection and Re-qualification of Fiber Reinforced High Pressure Cylinders, except as specifically noted herein:

(i) Cylinders with fiber damage (cuts, abrasions, etc.) that exceeds Level 1 type damage as defined in CGA Pamphlet C-6.2 and meet the following depth and length criteria are considered to have Level 2 damage:

(A) Depth - Damage that upon visual inspection is seen to penetrate the outer fiberglass layer but does not expose the carbon layer beneath, or that has a measured depth of greater than 0.005 inch and less than 0.045 inch for cylinders with an outside diameter greater than 7.5 inches or less than 0.035 inch for cylinders 7.5 inches or less in outside diameter;

(B) Length - Damage that has a maximum allowable length of:

Region	Direction of fiber damage	Maximum length of damage
Cylinder sidewall and domes	Transverse to fiber direction (longitudinal direction)	20% of the straight sidewall section length
Cylinder sidewall and domes	In fiber direction (circumferential direction)	20% of the straight sidewall section length

(ii) Cylinders with damage that meet the Level 2 criteria must be rejected. Requalifiers must contact the cylinder manufacturer in the event that the damage cannot be clearly interpreted based on these criteria. Repair of rejected cylinders is authorized for Level 2 type damage. Repairs must be made in accordance with CGA Pamphlet C-6.2, prior to the hydrostatic pressure test. Repairs must be evaluated after the hydrostatic test.

(iii) Cylinders that have direct fiber damage that penetrates through the outer fiberglass layer and into the carbon layer, or that have a measured damage depth of greater than the Level 2 maximum are considered to have Level 3 type damage. Cylinders that have damage with depth meeting Level 2, but length exceeding the Level 2 maximum are considered to have Level 3 type damage. Cylinders with Level 3 type damage are not authorized to be repaired, and must be condemned.

(iv) A hydrostatic requalification may be repeated as provided in § 180.205(g); only two such tests are permitted. Pressurization prior to the official hydrostatic test for the purpose of a systems check may not exceed 85% of the minimum required test pressure.

(2) Persons who perform inspection and testing of cylinders subject to this special permit must comply with § 180.205(b) and with all the terms and conditions of this special permit.

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(3) Requalification date (month/year) must be permanently marked on the cylinder as specified in paragraph 7.b.(1). The marking of the RIN symbol on the cylinder certifies compliance with all of the terms and conditions of this special permit.

d. OPERATIONAL CONTROLS -

(1) Cylinders manufactured under this special permit are authorized for a maximum service use of 30 years from the date of manufacture, provided the manufacturer meets all requirements specified under paragraph 8.a. of this special permit.

(2) Cylinders may not be used for underwater breathing purposes.

(3) A cylinder that has been subjected to fire may not be returned to service.

(4) Cylinders must be packaged in accordance with § 173.301(a)(9).

8. SPECIAL PROVISIONS:

a. Recall Program.

(1) Luxfer Inc. must formulate a recall program for service life extension within 12 months of the issuance of this special permit. The recall program must include detailed procedures for obtaining the cylinders from the field and prototype design qualification testing of each design type.

(2) Luxfer Inc. must randomly recall a minimum of thirty cylinders of each design type which have been in service for 10 and 15 years. Cylinders recalled after 10 years shall be designated "Group A" and cylinders recalled after 15 years shall be designated "Group B". All recalled cylinders must be requalified as specified in paragraph 7.c. above. All cylinders that fail to meet the requalification requirements must be condemned, removed from service and rendered incapable of retaining pressure. In the case that some units from the initial minimum lot size are condemned, additional cylinders must be selected and requalified as specified in paragraph 7.c. above, until a group of

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30 cylinders has been collected. These 30 cylinders constitute a batch for additional testing. The cylinders must be tested in accordance with Sections 8.5.4, 8.5.5, 8.5.7 and 8.5.8 of ISO 11119-2:2002. An Independent Inspector must witness all tests. Acceptance criteria shall be as defined in ISO 11119-2:2002 except $P_b = 1.8P_h$ and y must be greater than or equal to 20 for Group A and 15 for Group B.

(3) The complete test report including original test data must be submitted to the Associate Administrator for Hazardous Materials Safety for assessment within 30 days of completion. Failure to meet the acceptance criteria specified in this section shall result in the design being restricted to a maximum life of 15 years.

b. In accordance with the provisions of Paragraph (b) of § 173.22a, persons may use the packaging authorized by this special permit for the transportation of the hazardous materials specified in paragraph 6, only in conformance with the terms of this special permit.

c. A person who is not a holder of this special permit, but receives a package covered by this special permit, may reoffer it for transportation provided no modification or change is made to the package and it is offered for transportation in conformance with this special permit and the HMR.

d. A current copy of this special permit must be maintained at each facility where the package is offered or reoffered for transportation.

e. A current copy of this special permit must be maintained at each facility where the package is manufactured under this special permit and must be made available to a DOT representative upon request.

f. Each packaging manufactured under the authority of this special permit must be either (1) marked with the name of the manufacturer and location (city and state) of the facility at which it is manufactured or (2) marked with a registration symbol designated for a specific manufacturing facility by the Office of Hazardous Materials Special Permits and Approvals for a specific manufacturing facility.

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- g. The cylinders described in this special permit are authorized only for normal transportation as an article of commerce, i.e., the movement of hazardous materials packages from consignor to consignee.
9. MODES OF TRANSPORTATION AUTHORIZED: Motor vehicle, rail freight, cargo vessel, passenger-carrying aircraft and cargo-only aircraft
10. MODAL REQUIREMENTS: A current copy of this special permit must be carried aboard each cargo vessel or aircraft used to transport packages covered by this special permit. The shipper must furnish a current copy of this special permit to the air carrier before or at the time the shipment is tendered.
11. COMPLIANCE: Failure by a person to comply with any of the following may result in suspension or revocation of this special permit and penalties prescribed by the Federal hazardous materials transportation law, 49 U.S.C. 5101 et seq:
- o All terms and conditions prescribed in this special permit and the Hazardous Materials Regulations, 49 CFR Parts 171-180.
 - o Persons operating under the terms of this special permit must comply with the security plan requirement in Subpart I of Part 172 of the HMR, when applicable.
 - o Registration required by § 107.601 et seq., when applicable.

Each "Hazmat employee", as defined in § 171.8, who performs a function subject to this special permit must receive training on the requirements and conditions of this special permit in addition to the training required by §§ 172.700 through 172.704.

No person may use or apply this special permit, including display of its number, when this special permit has expired or is otherwise no longer in effect.

Under Title VII of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)—"The Hazardous Materials Safety and Security Reauthorization Act of 2005" (Pub. L. 109-59), 119 Stat. 1144 (August 10, 2005), amended the Federal hazardous

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materials transportation law by changing the term "exemption" to "special permit" and authorizes a special permit to be granted up to two years for new special permits and up to four years for renewals.

12. REPORTING REQUIREMENTS: Shipments or operations conducted under this special permit are subject to the Hazardous Materials Incident Reporting requirements specified in 49 CFR §§ 171.15 Immediate notice of certain hazardous materials incidents, and 171.16 Detailed hazardous materials incident reports. In addition, the grantee(s) of this special permit must notify the Associate Administrator for Hazardous Materials Safety, in writing, of any incident involving a package, shipment or operation conducted under terms of this special permit.

Issued in Washington, D.C.:



for Dr. Magdy El-Sibaie
Associate Administrator for Hazardous Materials Safety

Address all inquiries to: Associate Administrator for Hazardous Materials Safety, Pipeline and Hazardous Material Safety Administration, U.S. Department of Transportation, East Building PHH-30, 1200 New Jersey Avenue, Southeast, Washington, D.C. 20590.

Copies of this special permit may be obtained by accessing the Hazardous Materials Safety Homepage at http://hazmat.dot.gov/sp_app/special_permits/spec_perm_index.htm Photo reproductions and legible reductions of this special permit are permitted. Any alteration of this special permit is prohibited.

PO: Toughiry/NICKS